JPRS-CEN-92-012
3 December 1992

FOREIGN BROADCAST INFORMATION SERVICE

JPRS Report

Science & Technology

CHINA: Energy

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JPRS-CEN-92-012 *3 December 1992*

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Tokyo, Beijing To Start Environment-Friendly Coal Study

43070006 Tokyo KYODO in English 25 Nov 92

[Text] The New Energy and Industrial Technology Develpment Organization (NEDO) announced Wednesday that it will embark on a feasibility study with China to work out a scheme for environment-friendly uses of coal.

NEDO and China signed an agreement Wednesday on basic policies, including outlines of the study and role sharing, NEDO officials said. NEDO is affiliated with the Ministry of International Trade and Industry.

The joint study will be the first program overseas in line with the ministry's technology transfer project aimed at popularizing environment-friendly uses of coal all over the world, the officials said.

The agreement calls for Japan and China to study China's present uses of coal and the possibility of testing environmentally protective gears in coal-fueled thermal power plants from November 1992 through March 1995, they said.

They said 40 million yen is earmarked for the study during the current fiscal year, which ends next March, and 300 million yen for the next fiscal year.

China, Russia See Future Oil Co-op

40100028B Beijing CHINA DAILY (Economics and Business) in English 21 Oct 92 p 2

[Article by staff reporter Chang Weimin]

[Text] China and Russia, whose science and technology in petroleum exploration and development are believed complementary, are looking forward to co-operating in the field.

To that end, the president of Russia's State Oil and Gas Corporation, Churilov Lev Dmitrievich, is to lead a delegation to China next month to discuss co-operative possibilities.

The delegation is to talk with Wang Tao, president of the China National Petroleum Corporation (CNPC), and visit China's largest oil field, Daqing, in the northeast.

The eight-member Russian visit, the first of its kind to be led by a ministerial-level official, is in response to a September business tour of Russia led by Li Tianxiang, director of the Science Committee of the China National Petroleum Corporation (CNPC).

Li and his group had talked with Russian officials and experts and visited Russia's main oil fields. Possibilities for co-operation between the two nations were discussed at that time, the official said.

China's petroleum industry, after decades of development, is now capable of oil exploration and development overseas.

Neighboring, oil-rich Russia falls naturally into the range of targets of CNPC, which has decided on expansion of its overseas business as part of its strategy, Chinese experts said.

However, the CNPC official said, business talks have not yet brought up specific projects for co-operation.

Co-operation in science and technology for oil exploration and development is very likely to be reached first.

Many areas of technology developed by China's petroleum industry have reached international levels and some, such as techniques adopted in the Daqing oil field for stabilizing output from old oil wells, are unique.

CNPC expects to undertake oil exploration and development in small oil fields in Russia in the initial phase, the official said.

He added that oil exploration and development on any large scale in Russia may need substantial funding support. In that case, China is willing to join with firms from third-party countries.

CNPC officials believe that their firm is likely to be an internationally competitive power.

China now has 33 onshore petroleum development enterprises, which employ 670,000 people.

China produced about 140 million tons of crude oil last year.

Oil-Rich Areas Seek Investors

40100028C Beijing CHINA DAILY [BUSINESS WEEKLY] in English 9 Nov 92 p 1

[Article by Chang Weimin]

[Text] Massive foreign loans will be used to accelerate petroleum exploration and development in northwestern China, where enormous reserves have been confirmed.

Sources from the China National Petroleum Corporation (CNPC) said the central government is expecting billions of dollars worth of funds from overseas.

That means large quantities of foreign loans will be used in three oil-rich basins in Xinjiang Uygur Autonomous Region—Tarim, Turpan-Hami and Junggar.

China says it can pay back the loans with crude oil.

Chinese experts believe oil and natural gas reserves in the basins are strategically important for the country's energy production in the coming decades.

A strong labour force along with advanced technology and equipment from overseas have been at work in the basins for years.

Surveys and trial production have confirmed experts' beliefs that exploration and development call for large sums of money.

In Tarim alone, billions of tons of crude oil and thousands of billions of cubic metres of natural gas are believed to be underground.

Experts say the reserves of oil in Tarim may be equal to one-seventh of the total in China; natural gas reserves are believed to equal one-fourth of the total.

Some 17 billion yuan ($3.1 billion) is needed for exploration and development in Tarim during the 1991-95 period, in accordance with China's general plan for development of the petroleum industry.

Reserves in Turpan-Hami and Junggar are also immense, CNPC officials said.

China has bought sophisticated equipment from overseas for petroleum exploration and development in Tarim, which is surrounded by vast deserts.

CNPC officials said investment in the basin will be beefed up in the coming years.

Between January and August this year, some 562,000 tons of crude oil were recovered in Tarim, compared with 551,000 in all of last year.

Output in the three basins this year is expected to be 8.7 million tons, 970,000 more than last year's.

China has to quicken exploration and development in the three basins as maintaining stable production in older oil fields becomes more difficult, experts said.

CNPC has decided to open part of the three basins to foreign oil explorers and developers in an effort to speed the pace of development there.

The approval for that is expected soon from the central government and CNPC is now preparing to accept bids internationally, BUSINESS WEEKLY has learned.

Joint Deal for Oil Fields

40100028A Beijing CHINA DAILY (Economics and Business) in English 12 Nov 92 p 2

[Article by staff reporter Chang Weimin]

[Text] The Italian Agip (Overseas) Ltd, the American Chevron Overseas Petroleum Ltd and Texaco China BV, which have been co-operating with Chinese in the South China Sea for years, will further their joint efforts on petroleum exploration and development.

According to an agreement signed yesterday in Beijing, the China National Offshore Oil Corporation (CNOOC) will develop Huizhou 32-2 and 32-3 oil fields in the sea with the three foreign firms.

Enormous reserves have been confirmed in the two oil fields located in the mouth of the Pearl River.

Investment for the development was estimated at $280 million. Of the investment, 51 percent will come from CNOOC and the rest from the three foreign firms.

The oil fields are to go into production by the end of 1995, after which the four firms will start sharing recourses of as many as 1.5 million tons of crude oil each year.

CNOOC officials said conditions for oil development in the two oil fields, which are only 5.5 kilometres apart, are "good."

Facilities at existing oil fields will be used, including oil storage vessels, equipment for treating petroleum and pipelines. Huizhou 26-1 and 21-1, which are now in production, are only several kilometres away.

Under these conditions, the officials said, investment can be cut, the construction period shortened, and the potential for economic efficiency greatly increased.

The two oil fields were discovered at the end of 1990 by CNOOC and the three foreign firms that had worked there as an operation group.

CNOOC officials said high-quality oil reserves in the two oil fields are trapped underground in thick layers. The two oil fields are part of the 16/08 contract block, in which Agip, Chevron and Texaco have jointly explored petroleum for years.

Another two oil fields also have been discovered in the block and are slated for development, CNOOC officials said. Still more oil-rich areas are likely to be discovered as exploration deepens there.

The four oil firms expect Huizhou 32-2 and 32-3 oil fields to be high yielding, with stable production for years.

China opened the South China Sea to foreign oil firms in 1979. Since then, many oil firms from 14 countries and regions have entered the sea for petroleum exploration and development.

Helped by $3.2 billion of foreign investment, China's offshore oil production has been on the rise.

Latest statistics say offshore oil production between January and October 15 was 3 million tons, which means State targets for this year were fulfilled 77 days ahead of schedule.

CNOOC is predicting output for the whole year will exceed 3.5 million tons, compared with 2.4 million last year and 1.24 million in 1990. The annual output is planned to hit 10 million tons within five years.

Officials also expect Sino-foreign joint efforts to quicken petroleum exploration and development in the East China Sea.

Early this year, CNOOC announced its request for international bidding on two ocean areas, totalling

72,800 square kilometres. At least 63 foreign firms, including the world's highest-profile oil companies have already put in bids.

Heavy Energy-Consuming Industries to Migrate West With Development of Huang He

936B0005B Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 30 Sep 92 p 2

[Article by reporters Xu Xingtang [1776 5281 1016], Chen Chaozhong [7115 2600 0022] and Zhu Wenzhi [2612 2429 1807]]

[Text] The effects of the development of Huang He hydropower resources are already in evidence. The Lijiaxia and Daxia hydropower stations are under construction, and engineering preparations for Wanjiazhai and Xiaolangdi hydropower stations have begun.

The Lijiaxia hydropower station with 2 million kW of installed capacity will be the largest station on the mainstream of the Huang He, its scale of design equivalent to that of the Gezhouba hydropower station on the Chang Jiang. The water is already being diverted at the main dam of this station. Construction will be completed and the station will come on line in due course.

Seven stations have been built in sequence on the mainstream of Huang He at Longyangxia, Liujiaxia, JianGuoxia, Bapanxia, Qingtongxia, Tianqiao, and Sanmenxia.

The segment of the Huang He richest in hydropower resources is the stretch from Longyangxia to Qingtongxia, which extends from within Qinghai, through Gansu, and into Ningxia. Huang He hydropower stations provide the area with bountiful energy. Stations on the upper reaches of the Huang He now provide 50 percent of the total power supplied to the northwest power network. The ample supply of electric power and wealth of nonferrous mining resources has helped the area to become China's key nonferrous mining and metallurgy base. According to incomplete statistics, 20 nonferrous metals processing enterprises have sprung up in Gansu, Qinghai, Ningxia, and Shaanxi in the following order of importance: aluminum, bromine, copper and lead; and their accumulative output value is over 50 billion yuan. As Huang He hydropower is developed, high energy consuming industries concentrated in the north, northeast, and east, have begun to migrate westward.

Work Speeded Up To Electrify Counties

40100027b Beijing XINHUA in English 0848 GMT 12 Nov 92

[Excerpts] At present China is speeding up its construction of the second group of initially electrified counties, totaling 200.

The latest statistics show that in the first half of the year the generating capacity of the power supply projects under smooth construction in the 200 counties stands at 1.19 million kilowatts.

Moreover, they also erected 1,639 kilometers of high-voltage power transmission lines, built 76 substations with a total capacity of 280,000 kilovolt-amperes and they recorded an energy supply of 6 billion kilowatt-hours. As a result, 159,000 more families have started to use electricity in their daily life and other activities.

The investment for the power supply projects in this period totaled 770 million yuan. [passage omitted]

Construction of the first group of 109 initailly electrified counties was completed in 1989.

At present, of the toal generating capacity of 17.75 million kilowatts of the country's water and electricity departments, the generating capacity of medium-sized and small power stations accounts for more than 84 percent, reaching 14.94 million kilowatts. More than one-third of the country's rural counties use electricity generated by medium-sized and small power stations.

Gansu: Prospects for Vast Energy and Industrial Base

936B0002B Lanzhou GANSU RIBAO in Chinese 11 Sep 92 p 1

[Text] Pingliang's mineral resources are abundant. There is a rich reserve of metallic minerals, a boundless wealth of nonferrous metals, and the total reserves of coal alone is up to 3.44 billion tons, about half the total of the entire province. There are excellent prospects for development of energy and coal-chemical industries. As the Bao-Zhong rail line is completed, Huating coal field is developed, and the Pingliang power plant is built, the development of Pingliang as Gansu's energy industry and coal/chemical industrial bases will ensue.

The Huating mining district, the largest coal region in the province, includes coal fields at Huating, Anxin, and Chicheng. The Huating coal field covers an area of 54 square kilometers, and has five exploitable layers of coal averaging 28.7 meters in thickness with 1.94 billion tons of geological reserves. Anxin coal field occupies an area of 64 square kilometers with 6 to 10 exploitable coal strata with average thickness of 20-27 meters containing 1.32 billion tons of geological reserves. Chicheng coal field is 16 square kilometers with 110 million tons of geological reserves.

Huating mining district's coal quality is excellent, low in ash, sulphur, and phosphates, high in active charcoal, has high caloric value, and it compares favorably with the world famous coal of South Africa. Not only is it an excellent coal for daily use, but it also has excellent qualities for industrial motive power, and is the best coal in China for gasification.

Huating mining district has four primary advantages: 1. The development of the Bao-Zhong rail line presents convenient transportation for development of coal resources. It connects the inner district with the outside, and with domestic and foreign markets. 2. National interest in the overall development of Huating coal field is an impetus for development of the local coal industry. Huating coal field has been placed among the 15 national key mining district development projects, the overall layout of the united plan defines a resources domain, investments to reform existing mines and construct new mines, and broadens local coal production capability. Following is the Huating mining district construction program approved by the State Planning Commission: Full scale production is to be 14.59 million tons per year, 10.15 billion tons for the state and 4.44 billion tons for local use. Total investment will be 2.68 billion yuan. 3. The feasibility study for construction of the Pingliang power plant is done, it has been made a key construction project in the national Eighth 5-Year Plan, and it will be built by the National Energy Investment Corporation. A total of 3 billion yuan will be invested for a 1.2 million kW installed capacity. The Pingliang power plant will convert local coal resources into electric power, further stimulating the development of coal resources and local industries. 4. Advances in S&T will accelerate development of the coal-chemical industry. Annual output of synthetic ammonia will be 60,000 tons, urea will be 110,000 tons, and methanol 20,000 tons. The Pingliang chemical fertilizer plant, for which 500 million yuan will be invested, has passed preliminary feasibility assessment. Once completed, it can take advantage of available coal and electric power to develop an even larger array of coal chemical products, and enhance the capability of making comprehensive use of Huating coal field.

To speed the pace of construction of the Pingliang energy industry and coal/ chemical base, the Pingliang District has passed a series of preferential measures to attract foreign commerce and funds, and warmly welcomes specialists from all quarters to the project to put to good use their talents, and by the end of the century make Pingliang into Gansu's largest energy industry base.

New Liquid Fuel Could Replace Coal, Oil, Electricity

936B0003A Xian SHAANXI RIBAO in Chinese 21 Aug 92 p 1

[Article by reporter Liu Jincheng [0491 6855 1004]]

[Text] "Type-M liquid fuel", a fuel with great advantages for urban and rural domestic consumers that could replace coal, electricity, oil, and firewood, has recently been successfully manufactured by the Xi'an Feida New Energy Technologies Development Corporation.

This new alcohol-based liquid fuel is non-toxic, non-polluting and odorless. Added to the tank of a converted liquified-gas kitchen appliance, and ignited electrically, it can burn with a heating efficiency equal to that of liquified gas, and 15 kilograms can be burned continuously for over 60 hours.

Because of resource and financial constraints, China cannot meet present urban requirements for liquified gas. Many urban and rural domestic consumers still use coal and firewood as their main cooking fuel, which is wasteful of energy and pollutes the environment. The successful manufacture of this new liquid fuel will have a long range impact on the present backward structure of domestic fuel consumption.

Wind, Solar Power Utilization in Inner Mongolia

936B0003B Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 7 Sep 92 p 2

[Article by reporter A Sigang [7093 2448 6921]]

[Text] It has been learned from authorities that new energy installations are now distributed throughout the northern plains, including up to 950,000 wind-powered generators and over 5,000 solar batteries. These new energy installations now serve over 100,000 households in remote locations across the plains bringing to an end the use of oil lamps by agricultural and pastoral peoples.

It was said that solar energy resources in Inner Mongolia is second in the country, after Xizang, and the total resources of wind energy is 310 million kW, 20 percent of the reserves in the whole country, and is a key area for the development of wind energy. Since the early 1950s, the Inner Mongolia Autonomous Region, having had to face the task of improving lighting and heating in remote agricultural villages and pasturage areas, has lead the country in the development and utilization of new energy resources. Large-scale development and utilization of new energy was undertaken after the 3d Plenary Session of the 11th CPC Central Committee. In 1984 the Autonomous Region Government established a new energy resources group for overall planning and coordination of scientific research, production and dissemination of new energy technology.

Now there is a new energy scientific research, production, dissemination, and maintenance service system. According to incomplete official statistics, in 60 banners, counties, and cities throughout the Region there are 100,000 agricultural and pastoral households that have new energy installations, and nearly 1,000 homes are using solar-heated water. Over 200 passive solar installations of various types have been built, and there are up to 25,000 square meters of day-lighted areas. Over 3,000 solar sheds of various kinds for animals have been built for a total area of over 200,000 square meters. On the Xilin Gol plain, where the earliest use of new energy took place, there are now 30,000 wind-powered electric generators, according to the leaders of various leagues and cities, and at Urad Banner in Bayannur League the dissemination has reached 100 percent of pastoral households. The development and utilization of new energy in Inner Mongolia is moving from domestic applications into production applications. Inner Mongolia is first in the country in the distribution of small-sized wind-powered electric generators and solar batteries among agricultural and pastoral peoples.

Yunnan Grid Facing Serious Power Shortage

936B0002A Kunming YUNNAN RIBAO in Chinese 30 Aug 92 p 1

[Article by reporter Zhu Yangwei [2612 2876 0251]]

[Text] The Yunnan Economic Committee, Electric Power Bureau, and Provincial Tri-Power Office recently issued a joint notification for planning and restricting the use of electric power, requesting each locality to use the limited electric power where it is most needed to guarantee industrial and agricultural production and domestic needs. In the last year, Yunnan has experienced the worst drought in the last hundred years, dry conditions continue, and reservoir levels are dropping sharply. By 17 August, the main hydropower station reservoirs in the Yunnan electric power network, the Maojiacun and Erhai reservoirs, were below the previous year's levels by 19.01 meters and 1.01 meters respectively. Water for hydropower is critical, thermal power fuels are in great demand, and the electric power network is caught in a bind between supply and demand.

In order to give consideration to all sides, for the final months of this year and the first half of next year, every effort will be made to reduce losses to Yunnan industrial and agricultural production and economic development caused by shortage of power. The Provincial Economic Committee and organizations concerned are requesting power suppliers to adopt measures for stringently planned and restricted use of electricity, to absolutely assure power for combating drought and preventing disasters, and to protect energy resources, transportation, broadcasting, TV, posts and telecommunications, and important urban and rural livelihood. Buyers and sellers, especially, must conserve what must be conserved, and industrial electric power users must restrict what must be restricted.

Work Progresses Smoothly on "Little Three Gorges" Development

936B0001B Lanzhou GANSU RIBAO in Chinese 23 Aug 92 p 1

[Article by reporters Yan Ming [0917 2494] and Qiu Yongqiang [6726 3057 1730]]

[Text] The full-scale development phase of the Gansu Little Three Gorges hydropower project is underway. The construction of the Daxia hydropower station, with 980 million yuan invested, started in mid-October last year, and 900,000 square meters of earth and rock have already been excavated. The feasibility study for the Xiaoxia hydropower station, programmed together with the Daxia station, has been completed. The Wujinxia hydropower station passed feasibility assessment in Beijing on 18 August.

The developmental construction of the three hydropower stations is a key engineering project in the Gansu Eighth 5-Year Plan. The Daxia power station, 65 kilometers from Lanzhou, will be a large-scale station with an installed capacity of 300,000 kW, and an annual output of up to 1.46 billion kWh. The Xiaoxia and Wujinxia hydropower stations will be small scale. About 2.5 billion yuan have been invested for these three hydropower stations, and when completed they will greatly alleviate the electric power crunch that prevails in Gansu, and will boost agricultural irrigation engineering for the surrounding area. At the Daxia construction site, reporters witnessed a smooth operating first-class excavation operation, including a half-completed open diversion canal on which work is continuing day and night to assure that the diversion will be effected when the Huang He high-water season passes next year.

Work Begins on Nation's Second Big Pumped-Storage Station

926B0124B Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 12 Sep 92 p 1

[Article by reporters Pan Shantang [3476 0810 2768] and Su Huizhi [5685 2585 1807]]

[Excerpt] A ceremony for the start of construction and laying of the cornerstone for China's second large pumped-storage power station, the Beijing Shisanling station, were held at the site on 11 August. Premier Li Peng gave a speech at the ceremony and said that the Shisanling pumped-storage power station is a key engineering project for China and Beijing's Eighth 5-Year Plan, and when completed it will effectively solve the imbalance of supply and demand for electric power for Beijing, and will have an important impact on alleviating the power supply crunch during peak load periods.

Li Peng expressed hope that thorough cooperation among the participating engineers, workers, and foreign technicians working on the power station will ensure high quality, efficiency, and an early completion of the project.

The power station is located in the Shisanling scenic area of Changping County. The first of four 200,000 kW reversible turbine generators to be installed at this station is expected to go operational in 1995. When the station becomes fully operational, its annual output could be as high as 1.2 billion kWh. [passage omitted]

Work Begins on Heilongjiang's Lianhua Station

93P60060 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 13 Nov 92 p 1

[Text] Construction began recently on the Lianhua hydropower station in Heilongjiang Province. The project is a major item under the Eighth 5-Year Plan. The hydropower station will be the largest one built in Heilongjiang since the founding of the nation. The station's reservoir will have a storage capacity of 4.1 billion cubic meters and the station itself an installed capacity of 550,000 kilowatts. Total investment will be 1.86 billion yuan.

Asia's Largest Plant Planned for Sichuan

926B0124C Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 17 Aug 92 p 2

[Article by reporter Gao Zhu [7559 2691]]

[Text] Asia's largest thermal power plant, which will be built in Guangan County in the Nanchong district of Sichuan for a total investment of over 8 billion yuan, will have a total installed capacity of 2.4 million kW, and will occupy 3,000 mu of land. The Ministry of Energy Resources has declared this plant a key construction project, and it is now being examined by the State Planning Commission for approval. Once built, it will assure a supply of electricity for industrial and domestic use to the area, and will greatly alleviate the imbalance of electric power for the whole country.

Shanxi To Construct More Pit-Mouth Power Plants

40100027a Beijing XINHUA in English 0826 GMT 11 Nov 92

[Excerpts] Shanxi Province is planning to invest 50 billion to 60 billion yuan to build a group of new pit-mouth power plants with a general capacity of 18 million kW.

New electricity thus added will be transferred to provinces and municipalities including Guangdong, Jiangsu, Shanghai, Beijing, Tianjin, and Hebei. The total electricity the province exports will be raised from 7.8 billion kWh to 45 billion kWh annually. The consumption of coal in power generation will be increased from 12 million tons to 70 million tons. It is expected to effectively ease pressure on railway coal transportation and improve the province's economic efficiency. [passage omitted]

Backed by leading officials of the central government and departments concerned, the project has also been supported and coordinated by coastal provinces and Shanxi's neighboring regions.

Not long ago, Shanxi signed a construction letter of intention with Jiangsu Province to build a 4 million-kW power plant at Yangcheng in Shanxi Province. It is both possible and economically feasible to transmit electricity from Shanxi to Guangdong and Jiangsu Provinces.

According to the Electricity Research Institute under the Ministry of Energy, the cost of buying electricity from Shanxi will be no greater than building thermal power plants with similar generating capacity in the two provinces.

Shidongkou Update

936B0001A Shanghai JIEFANG RIBAO in Chinese 6 Sep 92 p 1

[Article by reporter Zhang Zhiyuan [1728 5268 6678]]

[Text] China's first supercritical high-capacity thermal power plant, Hua neng's Shidongkou No 2 power plant stands tall in Shanghai. The first supercritical 600,000 kW unit installed in the highest-level large-scale power plant of the Chinese electric power industry, has produced 1 billion kWh of electric power already this year, half of this year's planned annual power output. The first fire-up of the No 2 unit boiler at 11:14 AM on 3 September was successful, and it is now in the blowpipe test phase.

Huaneng's Shidongkou No 2 power plant, a minion of the Party Central Committee and State Council leadership, is China's first show-piece power plant featuring the world's most advanced power plant facilities and engineering management technology imported from the U.S., Switzerland and other industrially advanced countries. Investment for the first phase of construction of the two 600,000 kW supercritical units was 3.3 billion yuan, exceeding the total investment for the four Nanpu bridges. On 12 June this year the first 600,000 kW supercritical unit was turned on for 23 days of continuous operations (together with the subcritical unit), and was completely stable and safe under full-load operating conditions. Following the successful start-up of the No 2 unit boiler, routine shakedown and debugging will ensue for over a month, and then the unit will join the grid. In time, the Shidongkou No 2 power plant will generate 25 million kWh per day for Shanghai, which will greatly alleviate the shortage of electricity for manufacturing, construction, and domestic needs.

Guo Yuchao [6753 0056 6389], an official of the Shanghai branch corporation of the Huaneng International Electric Power Development Corporation, at the building site of the Shidongkou No 2 power plant on the south shore of the mouth of the Chang Jiang, told reporters that in order to meet the power requirements for the development of the entire municipality and Pudong, the higher authorities have directed that the second phase construction of the 3rd and 4th 600,000 kW supercritical units be placed on the agenda, and the Huadong Electric Power Design Academy has already been commissioned to proceed with the appropriate design preparations.

Henan Builds Large Coal Mine, Pit-Mouth Power Plant

40100013A Beijing XINHUA in English 0206 GMT 23 Oct 92

[Text] Zhengzhou, October 23 (XINHUA)—Construction of a large coal mine is going smoothly in the eastern part of central China's Henan Province.

Located in Yongcheng and Xiayi counties, the Yongxia coal field, which covers an area of 570 sq km, with a proven reserve of 1.9 billion tons of coal, is the only one of its kind to be opened up in eastern China.

On Tuesday, construction of the coal mine's two large pits with an annual coal output of 1.8 million tons started. Another two pits which are now being built are expected to go production in 1995. Construction of two more pairs of pits of the coal mine are expected to be started in 1994 and 1996 respectively.

So far, a 34-km railway, the Qingyong railway, has been built to connect the coal mine with the Liangyungang-Lanzhou and Tianjin-Pukou railways, two of the major railway lines in China. Besides, construction of a large thermal power plant is well under way at the coal mine.

The Yongxia coal mine, which will cost 3 billion yuan, is expected to turn out 100.5 billion tons of coal a year by the end of the century.

The coal mine will play an important role in easing the energy shortage in east China and promoting economic development in the area.

Foreign Cooperation Spurs Oil and Gas Prospecting

936B0011A Beijing RENMIN RIBAO in Chinese 30 Sep 92 p 1

[Article by reporters Wu Changsheng [0702 7022 3932] and Fei Weiwei [6316 0251 0251]]

[Text] The China petroleum industry has stepped up the pace of outside cooperation. Authorities of the China Petroleum and Natural Gas Corporation announced that concurrent with continuing to import foreign advanced technology China is increasing its participation in international oil exploration and development, and has received exploitation rights in one of Canada's heavy oil areas, is engaged in a joint venture in California for purchasing a small oil field, and is cooperating with the world's nine major oil companies in oil-sand extraction technology.

China's oil industry has made strides in the past year:

—Despite facing serious natural disasters at eight oil fields, month by month oil and gas output has exceeded planned quotas. From January to September, oil production was up to 800,000 tons over the same period of last year, reaching 103.61 million tons; natural gas was 11.3 billion cubic meters.

—Holding steady in the east and developing in the west is the emerging pattern. The Daqing experience with pumping water to sustain oil output has shown the way for maintaining production at other old oil fields in the east. In the west, the new Xiazijie, Lunan, and Shanshan oil fields show an annual output capability of 2.5 million tons, and preparations for full-scale development of Qiuling, Donghe, and Cainan oil fields are in the early stages.

—S&T advances can put this year's heavy oil production up over the 10 million ton mark, downhole operations measures can increase output by more than 10 million tons, and reach the highest level in the last 5 years.

—With improved scientific management, better downhole safeguards have raised the new well ratio. From January to August, oil-water wells have been increased by 7,358 shafts, and old wells by over 500 shafts.

Advances have also been made in prospecting, progress of construction is more rapid, and exploratory well completions and drilling footage rates are up more than 5 percentage points over the same period of last year. Major finds have been made in the three big basins of western China revealing a huge potential for large and medium-sized oil and gas fields. In the old areas of the east, new oil bearing tracts have been found. Natural gas prospecting has been so phenomenal that by year's end it is predicted that proven reserves will be 5 times the national plan, and requirements for the Eighth 5-Year Plan may be fulfilled in 3 years.

Coal, Electric Power, Crude Oil Production Set Record for Comparable Periods

936B0011C Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 17 Oct 92 p 1

[Article by correspondent Zhang Chaowen [1728 6389 2429]]

[Text] China's energy industry has good news: Coal, electric power, and crude oil production, which have a direct impact on a rapid expansion of the Chinese economy, have broken all records in the first 9 months of this year.

According to Ministry of Energy Resources' statistics, national output of raw coal from January to September of this year was 770.4694 million metric tons, a 77 percent increase over the same period last year. Chinese coal market stores are ample, the coal supply crunch has cooled off, and it is predicted that annual coal output could reach a new historical mark of 1.1 billion tons.

Electric power output is at full steam. Electric power production from January to September reached 547.44 billion kWh, completing 77.65 percent of the annual plan, 10.84 percent ahead of the same period of last year. In the last 9 months, the newly installed generating capacity was 7.281 million kW, giving China the world's fastest growing electric power industry during the same time frame.

National crude oil production from January to September was 106.4216 million tons, 75.74 percent of the annual plan, and 1.73 percent over the same period last year. This year, crude oil output could reach 142 million tons.

Natural Gas Found in East China Sea

40100031 Beijing CHINA DAILY (BUSINESS WEEKLY) in English 23 Nov 92 p 4

[Text] China has discovered high-yielding natural gas at the No 5 well of the offshore Pinghu Oilfield in the East China Sea.

This was revealed last week by the Shanghai Oil and Gas Company, which was set up last September. According to a spokesman, the daily output of natural gas at the well reaches 151,800 cubic meters.

The No 5 well is the company's first to strike natural gas in the Pinghu Oilfield. It was jointly built by the No 3 Marine Geological Prospecting Team under the Shanghai Marine Geological Prospecting Bureau, Sino-French-funded Bohai Geological Services Company, the Schlunberger Logging Company of France and the Drilling Technology Company of the China Bohai Oil Corporation.

The spokesman said Shanghai Oil and Gas hopes to collect necessary reference data for further and overall prospecting at the Pinghu Oilfield.

Testing of the natural gas at the well still continues and is expected to be completed next week.

According to the company's overall development plan, gas from the Pinghu Oilfield will be sent by pipeline to the Pudong New Area for household supply by 1996.

Outlook for Greatly Increased Oil Production Said Dim

40100014A Beijing LIAOWANG in Chinese No 35, 31 Aug 92; No 36, 7 Sep 92

[Article by Chen Xinhua [7115 2450 5478], Li Yongzeng [2621 3057 1073]: "Alarm Sounded for Major Oil-Producing Country"]

[No 35, 31 Aug 92, pp 13-14]

[Text] Editor's note: China is a major oil-producing country and its annual crude oil output ranks fifth in the world. China is also an insignificant oil-producing country because its per capita possession of resources only accounts for one-ninth of the world's average level. However, each year, 30 million tons of crude oil are burned directly. Oil is a limited resource and a resource-saving economy should be the only way for China's social development. [end editor's note]

Several years ago, an authoritative person made a pessimistic prediction, saying: If the question of oil is not properly settled, I am afraid, one day it will be impossible to boost output no matter how much money is spent.

Judging from the reality of oil industry developments, this prediction has unfortunately been fulfilled. Although the state modified the production plan by reducing crude oil production during the Seventh Five-Year Plan, and although it adopted some corresponding measures by increasing, to a certain extent, investment in the oil industry, we did not succeed in changing the passivity in crude oil production. In the early 1980's, the oil industry experienced fluctuations for several years in succession. The beginning of the 1990's saw two consecutive years of a low growth rate. Total crude oil output in 1991 was 139 million tons, an increase of only 600,000 tons over the previous year, or a mere 0.4-percent increase which was near a zero-percent increase.

We Do Not Have Much Oil Now

How could this happen! Analyses by relevant people show that there were at least the following three reasons for this:

1. Most of the major oil fields which have been put to use have entered, or are about to enter, the second half of the period of stable production and the average natural decreasing rate of oil fields has reached 15 percent, which is equivalent to a natural decrease of 20.85 million tons in crude oil output each year in terms of the energy produced by oil fields. In other words, the stable output at the present time is, in fact, the output increase. In order to increase an output of 10,000 tons, it is necessary to do an output-increasing job for approximately 20.86 million tons, of which 20.85 million tons are used to supplement the natural decrease.

2. Due to fund shortages for many years in succession, oil exploration has decreased. The available exploitable reserves have, in the past three years, been unable to match the volume of crude oil exploited in each of the years. Judging from the international oil industry, generally speaking, if the ratio between oil reserves and exploited volume is over 30:1, it is high; and under this ratio, oil production increases. If the ratio is 20-25:1, it is a medium ratio, and under this ratio, production can remain stable. If the ratio is below 20:1, it is a low ratio; and under it, oil production will begin to contract. China's present ratio between oil reserves and volume exploited is seriously out of balance and already exceeds the limit of stable production. Obviously, the future capacity for oil production is markedly insufficient.

3. Due to the long-term low price of oil, the entire oil industry has been making a loss for the past four years. The loss for this year is expected to reach 10 billion yuan, whereas the cost for oil production has increased by 23 percent over the past four years. The highest oil field cost is double the price of crude oil. It is expected that it will exceed international oil prices in four or five years. Very obviously, the self-developing capacity of the oil industry has weakened.

In short, the law of the natural decrease of energy production and the law of the natural decrease of profit, which energy-type industries themselves cannot resist, have seriously threatened the further progress and development of the oil industry. If we continue to place the oil burden on oil production, we will not only increase the state's economic burden but will, if we are not careful, probably bring irretrievable consequences such as the excessive exploitation of resources. Therefore, it is necessary to thoroughly consider and promptly resolve China's oil problem on the general plane of readjusting the internal oil production structure and oil supply-demand relationships. The success and failure of Renqiu Oil field is a typical example.

[No 36, 7 Sep 92, pp 14-15]

[Text] The condition of our resources is the foundation for the development of the petroleum industry, and is also the basic factor for deciding oil policy and solving the oil problem.

How much oil resources does China have? In 1987, the former Ministry of Petroleum Industry organized more than 1,000 scientific researchers in 22 oil fields throughout the country to conduct a nationwide oil resources assessment on the largest scale since the founding of New China. They reached the conclusion that inland and offshore oil reserves in our country were 78.8 billion tons, and that natural gas reserves were 33,300 billion cubic meters.

A Large Resources Country and a Small Resources Country

These figures were rather impressive, but the resources assessment was just a forecast and an inference no matter how advanced the means and methods could be, and they do not represent the actual quantities of resources that have been found through on-site prospecting and drilling. The resources reserves include many unknown factors and risk factors, and the figures can only be used for drawing up long-term development plans and general programs and cannot be used as grounds for actual economic activities. Therefore, the general international practice is to take the quantity of known exploitable reserves and actual production capacity to judge a country's potential and strength in oil resources.

According to the latest foreign statistics, our country's annual crude oil output has long ranked among the leading oil producers in the world, and now ranks in fifth place, next only to the CIS, the United States, Saudi Arabia, and Iran. As for oil reserves, those in Saudi Arabia account for one-fourth of the world's total; in the United States 4 percent; in Western Europe 2.7 percent; and in the whole Asia-Pacific region only 4.4 percent.

The figures show that China is a large oil-producing country; compared with countries with little or no oil reserves, China is also a large resource country. Moreover, the level of exploration remains rather low in general so there is still a broad vista for oil and gas exploration. As long as exploration is intensified, new reserves will certainly be found. This has been proven by the fact that in recent years, major breakthroughs have been made in prospecting for oil reserves in the west part of Tarim and in the new district of Duha. Even in the old areas of East China, where the degree of exploration is comparatively high, new reserves can still be found as long as exploration work is strengthened.

In this sense, China's oil industry remains in the ascendant. It is a "sunrise industry" in real terms rather than a "sunset industry." Pessimism and inertia are wrong and groundless.

However, we must also soberly note that the quantity of known exploitable reserves in our country is extremely incommensurate with our status as the fifth largest producer in the world. If our per capita oil reserves are compared with the world average, China is not a large resources country, but a small resources country.

According to statistics, per capita oil resources in our country are only one-ninth of the world's average; and for gas resources in our country we are only 1/24 of the world average. This is a scarcity in richness, and is the actual condition in our country which we should face squarely.

Petroleum and Energy Sources

Petroleum is one energy source. Compared with other energy sources, such as coal, hydroelectric power, and nuclear power, what position do oil resources hold? Coal is the main energy source in our country. It is estimated that our country's coal reserves account for 40 percent of the world's total. The quantity of known exploitable reserves is 900 billion tons. According to the current exploiting capacity, reserves can be exploited for 800 years. Hydroelectric power accounts for only 4 percent of total energy production. However, China's reserve of hydroelectric power rank first in the world, and per capita exploitable hydroelectric power is six or seven times oil reserves. Development prospects for nuclear energy cannot be underestimated either. Our country is very rich in natural uranium minerals, and prospects for exploitation are considerable.

Viewed from today's angle or from tomorrow's angle, our country cannot be considered "rich" in oil reserves compared with other energy sources; instead, we are "oil-poor" in terms of per capita possession, current reserves of resources, and the momentum of development.

Reality shows that the State Council's policy of "replacing oil with coal and reducing consumption of oil in all fields" is a sensible option suited to China's national conditions. "Substituting oil for coal as a fuel if coal is insufficient" is an extremely unreasonable measure in economic terms and is short-sighted behavior incongruous with national conditions.

Types of Natural Gas Traps in Ordos Basin Discussed

926B0126B Chengdu TIANRANQI GONGYE [NATURAL GAS INDUSTRY] in Chinese Vol 12, No 4, 25 Jul 92 pp 14-21

[Article by Tang Xianming [3282 7359 2494] of the Changqing Petroleum Exploration Bureau's Academy of Exploration and Development, Qingyang County, Gansu Province: "A Preliminary Exploration of Natural Gas Trap Categories in Ordos Basin"; manuscript received 12 March 1991, revised manuscript received 24 February 1992]

[Text] **Abstract** Based on the various types of information obtained from natural gas exploration in Ordos Basin and the geological characteristics of the basin, the categories of natural gas traps in this region are divided into four main types: paleo-geomorphic traps, structural traps, stratigraphic traps, and lithologic traps, and their respective characteristics studied. The importance of paleo-geomorphic traps was established. The central paleouplift, particularly the Zhidan-Fuxian region on its eastern side, is an important region in the search for paleo-geomorphic draped trap gas pools at the top of the Ordovician system. Structural trap gas pools mainly developed at the margins of the basin. The periclinal positions on the southern slope of Yimeng [Yih Ju

League] uplift and the central paleouplift are important regions to search for regional stratigraphic trap gas pools. The eastern part of the basin and the Yimeng region are important regions where upper Paleozoic sandstone body trap gas pools may have developed.

Key terms: Ordos Basin, gas pools, trap categories, paleo-geomorphic draped traps, distributional regularities.

I. Geological Overview

During its geologic history, the Ordos block was a part of the Tarim-North China platform. It is a cratonic block with multiple erosion surfaces on which the Paleozoic has a dual-layer structure. Its evolution underwent five phases:

1. Middle and late Protozeroic subsidence-elongation valley phase: In this phase, the Helan subsidence-elongation valley, Jinshaan [Shanxi-Shaanxi] subsidence-elongation valley, and Yushaan [Henan-Shaanxi] subsidence- elongation valley existed on the Ordos block from west to east. Their three connection points are located, respectively, near Haiyuan, Qishan, and Huaxian counties. Helan subsidence-elongation valley is the most typical. The Changcheng series and Jixian series accumulated in a thickness of about 2,000 m along a line from Shizuishan to Pingliang. Afterwards, it developed into an obduction zone. During this period, the embryo of the central paleouplift formed between Qingyang and Wuqi.

2. Early Paleozoic shallow sea platform phase: During this period, Ordos was part of the Great North China Basin. Neritic platform facies carbonate rock 400 to 1,000 m thick was deposited during the early Paleozoic. Its southwestern edge borders on the Qinqi sea trough and is a passive continental margin were over 4,000 m of carbonate rock accumulated, forming an enormously thick L-shaped carbonate rock zone. The early Ordovician Majiagou period first, third, and fifth segments in other regions were characterized by evaporite deposits where dolomitic limestone flats and gypsum-halite lowlands developed. The second, fourth, and sixth segments are characterized by continental surface open sea deposits where low-energy continental surface marine limestone developed over a large area. They form an excellent matching natural gas reservoiring and capping combination and exploration in them has now confirmed that the Ma 5 segment is gas strata. Caledonian orogeny during the late Ordovician uplifted the Ordos block as a whole and the Silurian, Devonian, and lower Carboniferous are absent. The central paleouplift during this period was in a period of growth and development. During over 100 million years of weathering and erosion, a paleo-karst zone formed in the weathered crust at the top of the Ordovician system and had major importance for the accumulation of natural gas.

3. Late Paleozoic near-shore plain phase: During this phase Carboniferous- Permian system coal-formed gas source rock developed and the sedimentation environment changed gradually from marine facies to marine-continental interchange facies and continental facies broad covering deposits, and two large gas generation centers formed in Uxin Banner and near Yan'an-Fuxian. The central paleouplift was in a deep burial form-finalization period during the Carboniferous and gradually disappeared by the late Permian. The Benxi group of middle Carboniferous sediments is a set of ferrobauxitic mudstone over 100 meters thick. It is apparent that the weathered crust at the top of the Ordovician system has an excellent generation, accumulation, and capping combination. It may reservoir lower Paleozoic oil-formed gas as well as upper Paleozoic coal-formed gas.

4. Mesozoic inland basin formation phase: During this phase the North China platform disintegrated and the independent Ordos Basin gradually took shape. Yanshan movement during the Jurassic created the larg overthrust nappe at the western margin of the basin and formed the western margin overthrust nappe zone, ending the history of long-term subsidence of the former subsidence-elongation valley zone. The effects of Yanshan movement on the position of the former central paleouplift uplifted its eastern part by a large amplitude and it eventually became the nose-shaped uplift structural zone of the Yi-Shaan [Yimeng-Shaanxi] slope.

5. Cenozoic peripheral fault-subsidence phase: Starting in the Tertiary period the mutual effects of the Eurasian and Indosinian plates formed several graben-shaped basins around the periphery of the basin.

In conjunction with sedimentation and structural characteristics and research targeted on Paleozoic oil and gas accumulation, the Ordos Basin can be divided into seven large structural elements (Figure 1).

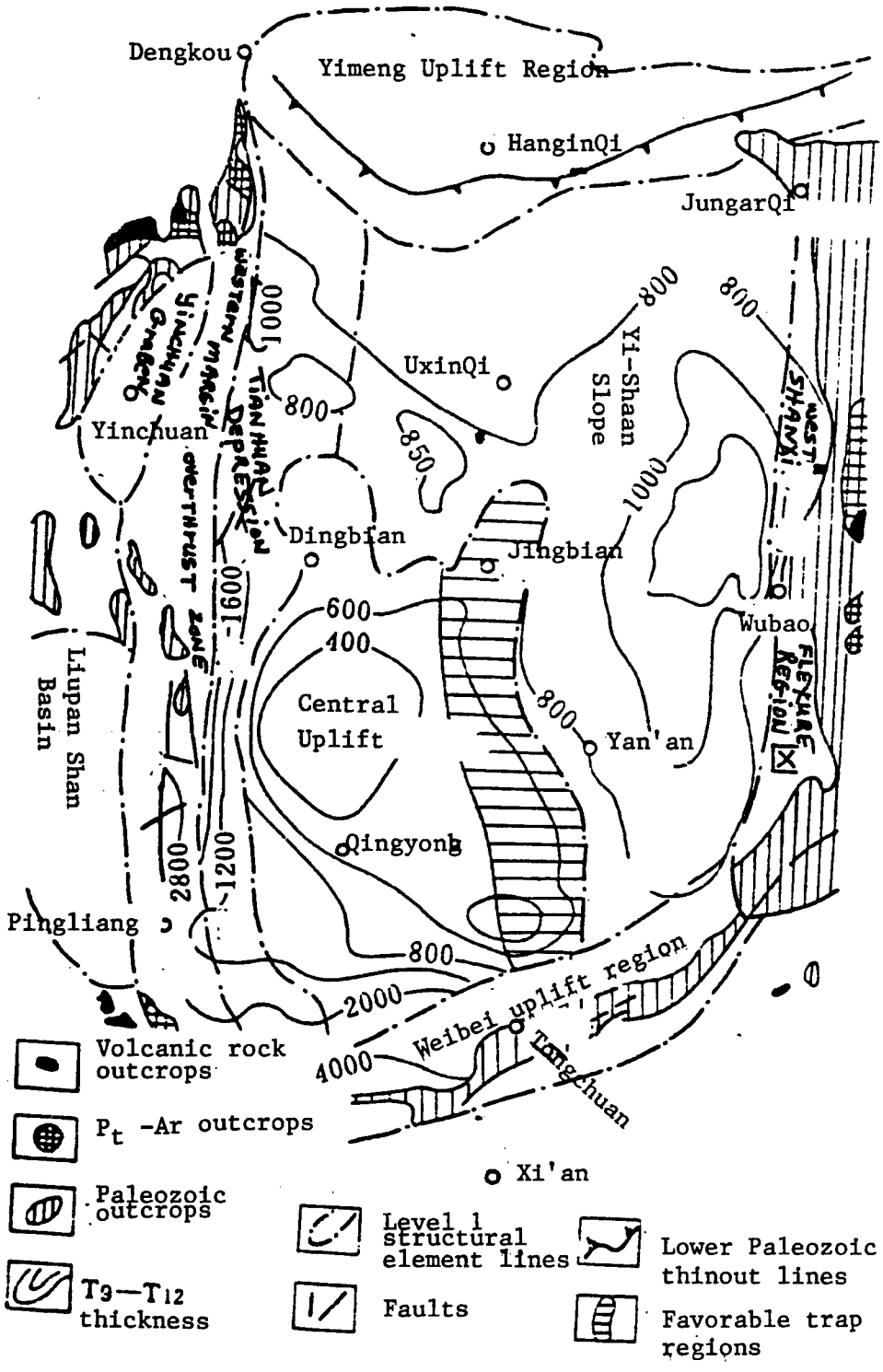

Figure 1. Demarcation of Paleozoic Structural Regions in Ordos Basin

II. Trap Categories

The Ordos Basin mainly developed two types of sedimentation systems: lower Paleozoic carbonate rock and upper Paleozoic clastic rock. Although the structures in the basin are gentle and level, erosion unconformity surfaces developed and there were many changes in sedimentary facies zones that led to existence of various types of concealed traps. Based on the results of recent natural gas exploration, I have classified the natural gas traps into four main types (Table 1).

Table 1. Classification Table of Natural Gas Trap Categories in Ordos Basin

Main category	Sub-category	Sub-category
Paleo-geomorphic traps	Buried hill draped structural traps	
	Buried platform weathered crust traps	
	Eroded valley traps	
	Compound traps	
Stratigraphic traps	Overlapping unconformity traps	
	Strata upward-sloping thinout traps	
	Diagenetic traps	
Lithologic traps	Clastic beach traps	
	Regional lithologic sheltered traps	
	Sandstone lens body traps	
	Hydraulic lithologic traps	
Structural traps	Anticlinal traps	Compressed dome traps
		Overthrust zone basal disc anticlines
		Salt dome structures
	Fault-associated traps	
		Semi-anticlines, fault anticlines
		Fault-horsts, high fault blocks
		Fault noses
		Fault platforms
		Fissures
	Penetration traps	
		Salt penetration
		Magmatic rock penetration

Reasons for including paleo-geomorphic draped traps: 1) With a prerequisite of categorizing traps according to formational factors, it was discovered that interpreting the formational reasons for the multitude of concealed traps solely as stratigraphic or lithologic traps was not sufficiently reliable. In the Ordos Basin, paleo-geomorphic draped traps occupy relatively important positions; 2) After the Caledonian orogeny, this region was uplifted with the North China platform and underwent over 100 million years of weathering and erosion, forming a karst paleo-geomorphology of intersecting hill-platform uplifts and erosion valleys at the top surface of the Ordovician system; 3) The paleo-geomorphologic units are different and they have their own unique sedimentation sequences, reservoiring and capping combinations, and trap categories; 4) There is weak folding within the basin, the strata are level and gentle, and anticlinal structures did not develop. The primary gas pools that have been discovered are mainly related to the karst paleo-geomorphology at the top of the Ordovician system.

Gas pool traps are composed of three parts: reservoir strata, capping strata, and sheltering bodies. Their shape and formational factors concern three types of deformation and displacement mechanisms. For this reason, consideration was given during categorization to the volume and shape of the traps as well as to their formational factors in conjunction with the actual conditions of the eroded paleo-geomorphology at the top of the Ordovician system in the Ordos region. The characteristics of each type of gas pool trap are described below.

A. Paleo-geomorphic draped traps

Crustal movements like the Luliang at the end of the early Protozeroic, Jining at the end of the Jixian period, Caledonian at the end of the early Paleozoic, and so on caused this region to be eroded during these periods and formed an ancient eroded surface. This was especially true of the karst paleo- geomorphology of the eroded surface of the Ordovician system that formed as the

result of the Caledonian orogeny, and it played a decisive role in natural gas accumulation and gas pool development in this region.

1. Ancient buried hill draped structural traps

After the middle Ordovician, the Caledonian orogeny caused uplifting of the region of the basin as land with the exception of its southwestern edge, and it underwent a long period of weathering and erosion. The weathered surface of the Ordovician became a karst geomorphology and ancient buried platforms, ancient buried hills, and ancient buried ravines of varying sizes developed. During late Paleozoic sedimentation, because of the effects of filling and differential compaction, draped structures with thin tops and thick flanks formed on the residual hills and were strengthened by structure movements during later periods. Examples include the Lijiachang, Qinlin'gou, and other gas pools. The former is located in the northern section of the Tianhuan depression, the T_9 (a reflection near the coal seam in the top part of the Carboniferous Taiyuan group) has a structural amplitude of 28 m, and the closed area is 4.5 km^2. The Li-1 well drilled into the top of the structure produced a daily output of more than 10,000 m^3 of natural gas from Taiyuan group sandstone. The latter is a trap that formed on the ancient residual hills of the Carboniferous system that are draped over the Ordovician system. Seismic measurements indicate the top part of its Ordovician system has an uplifting amplitude of 40 m and a width of 9.4 km. The Lincan-1 well drilled into the uplift produced an industrial gas flow. The generation strata are Permian system sandstone and Carboniferous system Taiyuan group limestone.

The die-stamp method and trend surface analytical research led to the discovery of several dozen residual hills of varying sizes in the southern part of the basin, including Shangliyuan, which is a buried hill draped anticline. Their discovery provides a clue for future expansion of natural gas exploration realms in this region.

2. Ancient buried platform and ancient buried hill weathered crust traps

Seismic prospecting in the Yimeng region in the northern part of the Ordos Basin led to the discovery of bedrock uplifts in several locations including Yashitu, Boersai, Shiniwusu, Hangin Qi, and others (Figure 2). During their geological history, these bedrock uplifts were exposed at the surface for long periods and underwent weathering, and formed pore accumulation spaces. Drilling has revealed that wells drill directly from the Carboniferous system into Protozeroic and Archaeozoic strata and that the drilling time is accelerated. It was discovered that the cores from them contained loose clastic weathered residual sediments that are very good reservoir strata. The argillaceous rock low-permeability strata covering the unconformable surface serve as capping strata and may have formed metamorphic rock buried hill traps.

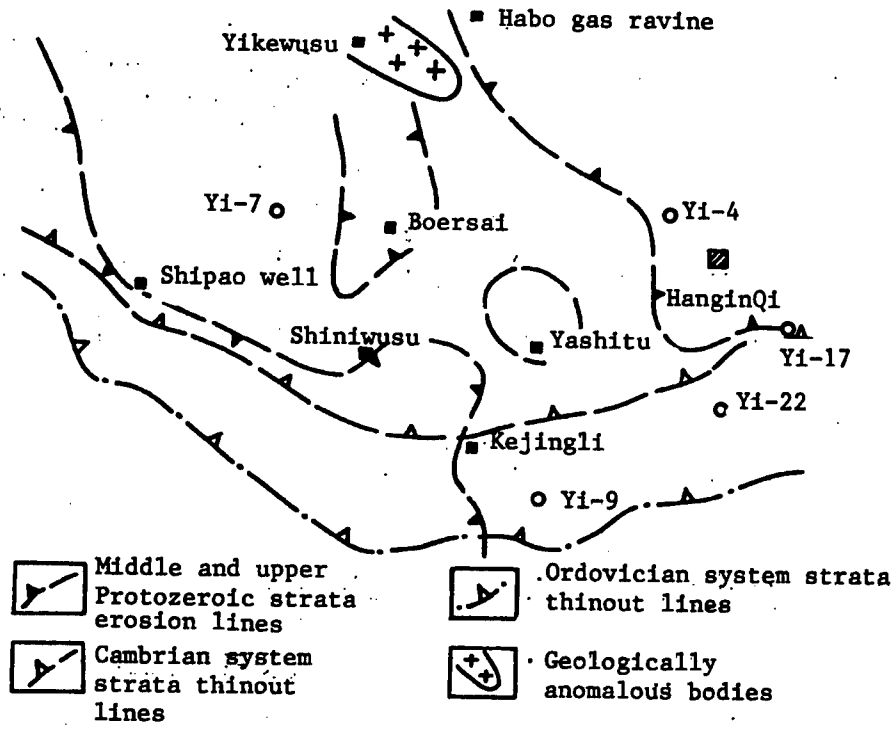

Figure 2. Lower Paleozoic Strata Thinout Lines and Crystallized Bedrock Uplift Distribution in the Hangin Qi Region

Among the paleo-geomorphic traps, carbonate rock ancient buried platform weathered crust traps are the most important. Buried platforms refer to "platforms" with a relatively broad karst paleo-geomorphology that have slightly uplifted strata but are higher than surrounding regions and also cover relatively large areas. An example is the Jingbian-Hengshan buried platform trap. This buried platform is located at the northeast end of the central paleouplift. Preliminary indications of a large gas contour were seen during dissective exploratory drilling. Since the Paleozoic, this buried platform region was basically in an uplifted position or structural saddle, which always indicate the direction of oil and gas migration. Its eastern side is a platform-depression with a rather small amount of activity that is a lower Paleozoic gas generation center. Its paleo-geomorphic background is the Jingbian-Zhidan-Yichuan karst slope. Cracks and holes formed in the top part of the Ordovician system in the buried platform region and it is an ancient karst weathered crust 30 to 100 m thick. Comprehensive analysis of G-LOG and SEIS-LOG profiles and drilling indicates that the Ordovician system weathered zone at higher positions on the paleostructure have good reservoiring properties. The eastern side of the buried platform is a buried ravine. Ma 5^{1-3} are absent in the buried ravine and it was filled with Carboniferous system argillaceous rock forming an upward-sloping shelter for the buried platform region. This Ordovician system weathered crust reservoir strata, capped and sheltered by a cover of Carboniferous system ferrobauxitic mudstone, has the basic geological conditions for rich accumulation of natural gas in the buried platform region (Figure 3).

3. Eroded valley filled traps

Several eroded valleys, i.e. buried ravines, were discovered from interpretation of seismic prospecting data. During middle and late Carboniferous sedimentation, buried ravines in the top of the Ordovician system were filled with clastic rock bodies. With the arrival of flood seasons, sand bodies extended until they thinned out toward one side of the buried ravines. Carbonate rock on the valley walls became shelters and formed valley wall traps. Gas pools in this category have not yet been discovered.

4. Complex traps on the paleo-geomorphic background

Many types of complex traps exist in this region. Ancient nose-shaped uplifts and lithologic compound traps are one of them. In the eastern part of the basin, the Jiaxian-Zhenchuanbao-Qilin'gou nose-uplift zone and Yulin- Zhaoshipan nose-uplift zone are nose-uplift and lithologic trap gas accumulation zones. Prior to Carboniferous sedimentation, these nose-uplift zones had an ancient residual hills or ancient nose-uplift geomorphology. "Smoothing and filling" sedimentation took place on the top surface of the Ordovician system in the upper Paleozoic and differences in sedimentation conditions caused variations in small strata sedimentary facies. Combined with different structural positions, the result was differential compaction that formed a combination of compacted nose-uplifts and lithologic traps. Zhenchuanbao and Zizhou gas fields in the Jiaxian-Qilin'gou nose-uplift zone fall into this category (Figure 4). In the Zhenchuanbao gas field, the generation strata are Permian system lower Shihezi group and Shanxi group river channel sandstone. The sandstone strata are gas strata in the axis of the nose- uplifts, and the reservoir strata in inclined positions thin and disappear. The accumulation conditions at the same positions at the Pu-1 and Yu-10 wells on the southern and northern flanks become poorer and they did not generate gas. In the Zizhou gas field, the

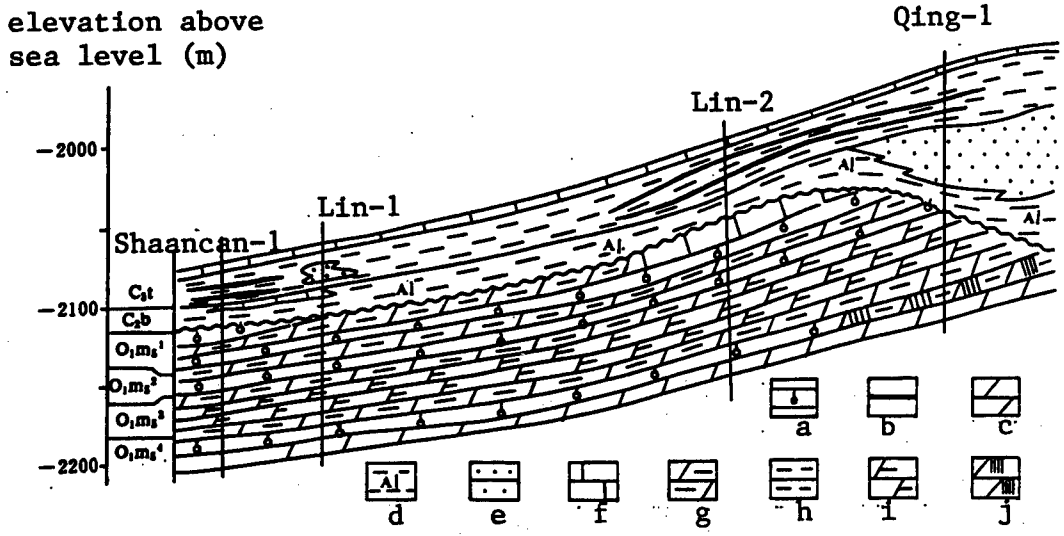

Figure 3. Jingbian-Hengshan Gas Pool Profile Diagram

Key: a. Gas strata; b. Coal seams; c. Dolomite; d. Bauxitic rock; e. Sandstone; f. Limestone; g. Argillaceous dolomite; h. Mudstone; i. Muddy dolomite; j. Gypsum-dolomite

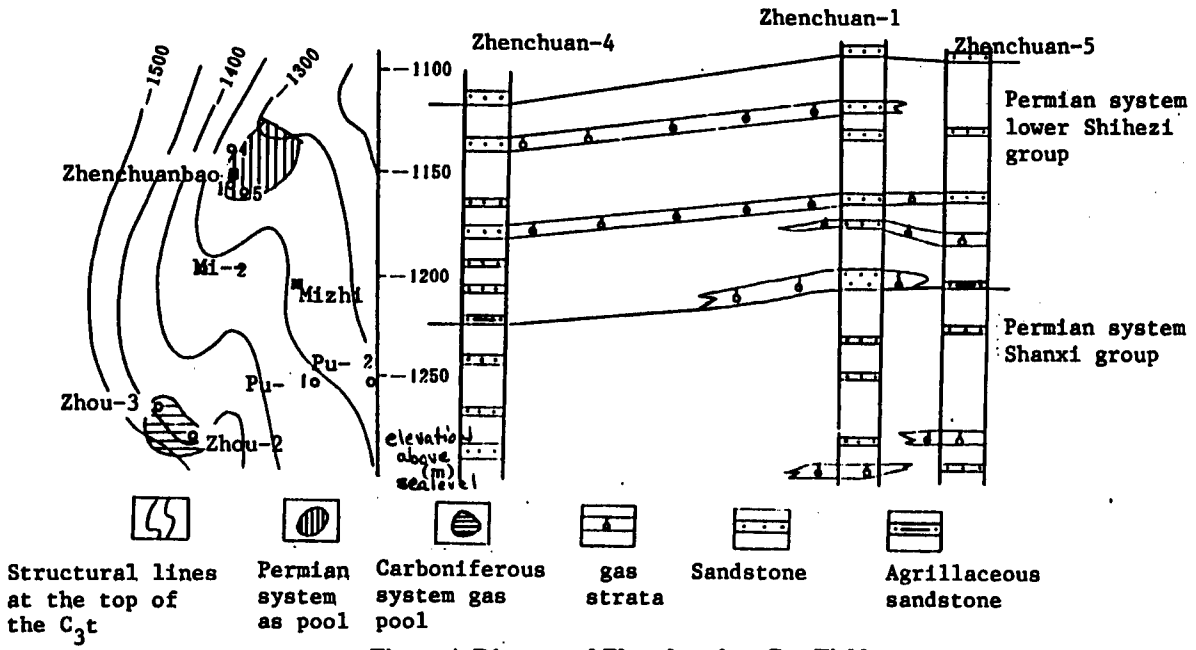

Figure 4. Diagram of Zhenchuanbao Gas Field

upper Paleozoic generation strata are Carboniferous system Taiyuan group sloping channel limestone and narrow ravine limestone. At the Pu-2 well on the inclined position of the nose-uplift, a shelter was formed because the material properties were poorer, which formed a structural-lithologic trap.

B. Structural traps

These are traps formed by deformation and displacement of strata caused by structural activity. In this region, these are distributed mainly around the periphery of the basin. They can be further classified into three subcategories according to the principle of shape categories.

1. Anticlinal traps

These can also be divided according to formational factors into compressive- type arched anticlines, overthrust basal disc anticlines, and salt dome structures.

a. Compressive arched anticlines: These are arched structures formed during multiple periods of structural activity due to lateral compressive force created from strata folding in regions with concentrated stress and regions with many variations in stress. Some are continuously uplifted-type structures formed during the Caledonian period. Most of the traps in this category developed at the deep areas ahead of overthrust zones and in arch-shaped structural zones. This category includes Tianchi, Gufengzhuang West, Guanjialiang, and other traps in the basin with low, gentle anticlines and several anticlines in the Hangin Qi-Qintailiang arch-shaped structural zone.

b. Overthrust zone basal disc anticlines: These developed mainly in the overthrust zone at the western margin. Below the decollement plane in the Majiatan thrust fault region, there is a large and integral basal disc anticline zone, the Kushui-Lugouzi anticline zone. It has several anticlines in echelon that form an asymmetrical anticline zone nearly 40 km long and about 20 km wide. Paleozoic gas strata were discovered in exploratory wells drilled into the Kushui and Lugouzi anticlines.

c. Salt dome structural traps: In the Mizhi Ordovician salt lake region in the eastern part of the basin, structural activity and non-homogeneous covering pressures caused plastic flows in the saline rock and caused strata above the saline rock to arch upward and form salt dome structures. Indications of rub folding phenomena have been seen in seismic time profile analysis and examinations of rock cores from wells, and both the Zhenchuanbao uplift and west Shanxi Guyi uplift are related to salt dome structures.

2. Fault-associated traps

Most of the traps in this category are distributed in the fault-fracture zones at the margins of the basin. Whether or not they became gas pools is related to the lithology of the strata on both sides of the faults and is determined by capillary pressure differentials in the strata to which they are connected. When the capillary pressure differential in impermeable strata on one side is greater than that in the permeable strata on the other side, the permeable strata side can form gas pools. The traps in this category can also be divided into semi-anticlines, fault-anticlines, fault-noses, fault-horsts, fault-steps, and so on. The shape characteristics of semi-anticlines are that one of

their flanks is a fault that can play a role in closure. Fault- anticlines differ from them in that they are located a high positions in structures and are dissected by transverse faults. Fault-noses are enclosed by faults at high positions on nose-uplifts. Twenty-four traps of this type were discovered in the Hengshanbao fault-fold region in the obduction zone at the western margin and seven of them are known to contain gas, such as the Shenglijing, Kashitu East, and other gas pools. Intense thrust faulting activity at the western margin of the basin caused the development of large fractures and it fragmented structures, forming several small gas pools, mostly in the upper Paleozoic.

3. Penetration traps

Drilling data indicates that relatively thick gypsum-halite strata were deposited during the Ordovician Majiagou period in the Suide-Yulin region, so the conditions for salt penetration were present. Near the Taokeng seismic CDP1380 measurement line east of Suide, for example, there is a break in the reflected waves between T_{10} (top of the O) and T_{11} (bottom of the O) and upward bending of the reflected waves, forming a local "blank seismic facies" (Figure 5) [not reproduced]. There are similar indications in the seismic profile near Jiaxian. The locations where they appear correspond to gravitational negative anomalies and they are located in the low strata velocity region in the Ordovician system. It has been inferred that they are penetration structures that formed under high temperatures and high pressures when saline rock underwent plastic flow toward regions of low potential.

Large-scale magmatic intrusion also occurred during the Yanshan period in the Zijinshan region of Shanxi and caused uplifting of the reservoir strata and formed penetration traps sheltered by the intrusive masses. Several short-axis anticlines surrounding the intrusive masses exist around the intrusive masses at Zijinshan (such as the Zhaojiaping, Yaojiahui, Jingliangsi, etc.). A shallow well drilled into the Zhaojiaping structure produced a small amount of natural gas, indicating the importance of this type of trap. In another case, a seismic reflection anomaly body also appeared at Yikewusu in the Hangin Qi region (Figure 2). Its location corresponds to a magnetic high and it is inferred on this basis to be a magmatic rock intrusion structure.

C. Stratigraphic traps

These include overlapping unconformities and upward-sloping thinout traps.

1. Overlapping unconformity traps

Traps in this category exist mainly between the Cambrian and Ordovician systems and between the Ordovician and Carboniferous systems. Overlap phenomena exist in Ordos Basin on the western side of the central paleouplift, the northern side of Weibei uplift, the southern slope of Yimeng uplift, and in the Paleozoic. The middle Ordovician system is gradually ablated by strata moving from west to east on the western side of the central paleouplift and the lower and middle Ordovician systems are in direct contact with the Carboniferous system. Seismic reflected wave characteristics indicate that the middle Ordovician system is absent east of Manghantumiao-Lihuatai-Pengyang and north of a line from Lingtai-Fuping, and that it spreads out in an L shape. This type of erosion structure unconformable geological structure inevitably causes the formation of regional unconformity traps.

Ulanger in the northern part of the basin was in an uplifted position for a long period. Reflected wave images of northward overlapping of the upper Paleozoic and northward ablation of the lower Paleozoic can be seen in all the south-north profiles on its northern slope (Figure 6) [not reproduced], forming unconformable contacts between the Ordovician system and the strata systems of the Archaen system, Protozeroic system, and lower Paleozoic system. Seismic data indicate that the lower Paleozoic thins out in a wedge shape from south to north near an almost east-west striking line from Baiyanjing-Dugui Qarga-Qintailiang. The strata below the unconformity were subjected to long periods of erosion and weathering that improved their reservoiring properties, and it has been inferred that this zone may have formed regional stratigraphic traps (Figures 1 and 2).

2. Strata upward-sloping thinout traps

In positions around the central paleouplift, the northern slope of Weibei uplift, and sloping regions within the basin, the Paleozoic thins out in upward-sloping positions and formed stratigraphic trap gas pools in the dense rock strata. This type of gas pool has been discovered in upper Paleozoic strata in the Hengshanbao fault-folded region in the western part of the basin and in the Suide and Yulin regions in the eastern part of the basin. The Mizhi East T_9 reflection layer structure is a monocline that is uplifted to the east. Several late Paleozoic river channels were discovered from drilling and seismic interpretation. Lateral variations in river channel sand bodies and river flood plain argillaceous rock were conducive to the development of sand bodies with a nearly south-north strike that thin out to the east (in an upward-sloping direction on the structure) and formed gas pools. For example, from the Shanxi group gas strata at the Yu-9 well to the Yu-11 well about 16 km to the eastern side, the corresponding strata positions become argillaceous sandstone where no oil and gas indications were seen.

Weibei uplift forms an echelon-shaped staggered drop and the Carboniferous and Permian systems thin out toward the south. The middle Ordovician system also thins out north of Fuping and it is expected that strata upward-sloping thinout traps may have formed.

3. Diagenetic traps

These refer to stratigraphic-lithologic traps formed by changes in the structure of rock composition from the effects of diagenesis and epigenesis in sedimentary rock.

They are frequently seen in this basin in association with ablation in the form of breccia-shaped limestone traps and dolomite traps formed by dolomitization.

a. Interformational karst—breccia-shaped limestone traps: During its diagenetic process, Majiagou group limestone underwent four stages of transformation in a penecontemporaneous phase: burial at shallow depths below the ground surface, exogenic diagenesis-weathering diagenesis, and reburial and recrystallization. During the exogenic diagenesis-weathering diagenesis phase, intense leaching, karsting, brecciation, and removal of gypsum-halite caused an increase in pores, holes, and cracks and, although it did undergo compaction and pressure solution during later periods, it still retained excellent reservoiring material properties and formed pools. Tianchi gas pool, besides being a structural trap, also has the characteristics of an interformational karst block-shaped trap. Drilling revealed that dissolution pores and holes developed in the algal limestone in the upper part of the lower Ordovician system Kelimoli group, and interbreccial vugular pores and solution cracks and intragranular vugular pores are also very developed. The seismic G-LOG profile has lens-shaped and band-shaped low velocity anomalous bodies with a wave velocity of 4,250 to 4,500 m/s. The Tian-1 well low velocity anomalous body is the thickest, followed by the Tianshen-1 well, while the Tian-2 well is the thinnest. Obviously, the Tian-1 well located at a high position on the structure has excellent material properties with a porosity interpreted from electrical measurements of 19.9 percent, and it produced a high-output gas flow. The Tianshen-1 and Tian-2 wells located at lower positions on the structure have significant cementation and filling and the material properties are obviously poorer. Added to its separation from small faults in Ordovician system strata, it did not generate gas. The Tian-1 well is a gas pool controlled by dual interformational karst and structural factors created by diagenesis.

b. Dolomitized diagenetic traps: These are sedimentary facies variation zones in carbonate rock. Intense dolomitization formed banded dolomitized traps enclosed on four sides by non-dolomitized limestone that have excellent reservoiring properties. Traps in this category developed mainly in open sea and restricted sea facies alteration zones and in gypsum-dolomite flats and restricted sea facies alteration zones at the southwestern margin. During the Majiagou period, for instance, Yulin-Yan'an was a gypsum-halite lake or gypsum-dolomite-bearing flat, Uxin Qi-Jingbian was a local sea, and the southwestern margin was an open sea. Banded dolomitized diagenetic traps may have formed in the alteration zones of these different sedimentary facies.

D. Lithologic traps

These refer to concealed traps formed by lateral changes in the lithology of reservoir strata or longitudinal interruptions in the continuity of deposits. These can be divided more precisely into four subcategories according to reservoir strata types:

1. Clastic beach traps

Based on research achievements regarding the lithofacies paleogeography of the Ordovician Majiagou period, bioclastic and oolitic beach facies deposits exist at the northern end of the Tianhuan syncline and in places at the margin of the Weibei platform like Bulike, Lijiachang-Tianchi, Longxian, Tongchuan, and others. Field geological surveys discovered enormous coral reef blocks and algae-bonded rock in Ordovician system platform slope landslip deposits in the Jingyang Tiewagu area. Some seismic time profiles also show hill-shaped anomalous bodies. It is expected that clastic beach, oolitic beach, and organic reef traps may be found in the Weibei region and the region at the margin of the platform in the western part of the basin.

2. Regional lithologic sheltered traps

The area to the east of the Shen-1 well—Shaancan-1 well—Yanshen-1 well is an Ordovician system salt lake and gypsum-dolomite-bearing flat region. On a background of a westward-sloping monocline, carbonate rock with reservoiring properties is sheltered in an upward-sloping direction by gypsum-halite near a line from Yulin-Jingbian-Yan'an and may have formed regional lithologic sheltered gas pools. The Jingbian Ma 5^4 high-pressure gas pool that has now been discovered may be the first example.

3. Sandstone lens body lithologic traps

Exploratory drilling and seismic stratigraphy research indicates the upper Paleozoic network rivers developed to the north of Tianchi and in the Suide- Yulin region. The point sand barriers and branch river channels in the river channels may have formed sandstone lens body lithologic traps. At the Zhenchuan-1 well, for example, Shanxi group gas-bearing sandstone was 6 m thick and a single stratum produced 10,000 m^3/d of gas. The corresponding positions at the Zhenchuan-5 well located about 1.5 km from its eastern side and the Zhenchuan-4 well located about 2 km to the northwest of it change to argillaceous rock and should be classified as typical sandstone lens body gas pools (Figure 4).

4. Hydraulic lithologic traps

There are low permeability monoclinal strata closing the basin that are replenished by groundwater in an upward sloping direction. Gas-water permeability variations in the low permeability rock strata and hydraulic head closure may have formed water-sealed gas traps. Research indicates that the Sui-2 well to Sui-1 well Carboniferous system gas pools south of Suide are in this category[1]. Taiyuan group limestone at the Sui-2 well produced gas and the same stratum at the Sui-1 well about 15 km from its eastern side (98 m above sealevel) produced water. The Paleozoic outcrops in the Lishi-Lilin area in the eastern part of this gas pool and it is a groundwater replenishment region that is in a pressure-bearing environment within the basin. A water pressure head exists in thc Yulin-Suide

region, so water-sealed gas pools may have formed in Carboniferous system low-porosity and low-permeability limestone (Figure 7).

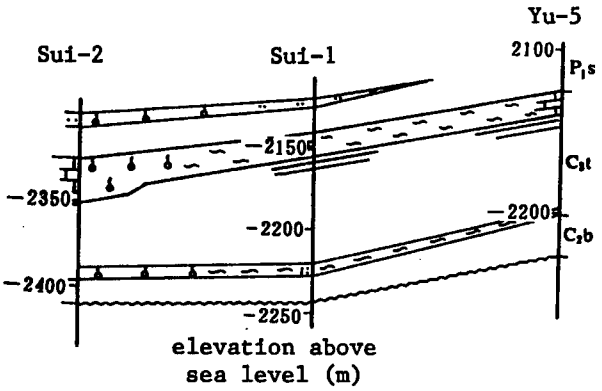

Figure 7. Profile of the Paleozoic Gas-Water Relationship From Sui-2 to Yu-5 Well

III. Preliminary Understandings

As oil and gas exploration unfolds in depth and breadth and petroleum geology science develops, current understandings and judgements concerning trap formation have become increasingly strict and accurate. For this reason, it can be felt that paleo-geomorphic, structural, stratigraphic, and lithologic factors are the four main pillars in trap formation in the Ordos region.

Traps are a unique type of pool-forming geologic body. Generally speaking, a basin's category is determined by its geological structure and sedimentary facies zones, while its geological structures and sedimentary facies zones are in turn determined by a basin's category and its scale. This is also the basic starting point for research on traps in the Ordos Basin. To summarize the preceding sections, several points of understanding can be derived:

1. Within the basin, the crust is stable, the strata are gentle and flat, there are extremely few faults, and anticlinal structures are extremely undeveloped, so oil and gas exploration must break through the convention of focusing solely on anticline traps and should be concerned with discovering non-structural traps. The search for traps should be solidly integrated with regional crustal activity characteristics, and most structural traps developed at the margins of the basin. For example, structural traps related to faults may be found at the overthrust zone at the western margin and arched anticlines may be found at its front edge. Echelon anticline traps may be found in the Hangin Qi-Qintailiang arch-shaped structural zone.

2. The overall stability and great variations in sedimentation systems in the basin's ventral structures determine that non-anticline traps have an important status. The primary factors affecting the great variation in sedimentation systems are ancient erosion surfaces or unconformable surfaces. Research on erosion surfaces should do matching analysis of their uplifted shape, covering sediments, and underlying strata. For Ordos Basin, research on the erosion surface at the top of the Ordovician system will inevitably be aimed at the Ordovician system weathered crust and its covering Carboniferous system ferrobauxitic strata and at the Carboniferous system Taiyuan group Jinci sandstone. It is apparent that research on erosion surfaces truly has the effectiveness of the "one arrow and two engravings" (reservoir strata, traps). Paleo-geomorphic draped traps in the basin's central paleouplift region occupy an extremely important status, and of course the Mizhi salt marsh region salt dome and sedimentation system variation lithologic traps cannot be ignored.

3. A large gas field has now been found at the northeastern end of the central paleouplift. The over 10,000 km^2 Zhidan-Fuxian region on the eastern side of the central paleouplift should be a favorable region to search for a variety of types of natural gas traps. Zilin gas generation center in this region has an excellent reservoiring and capping combination. Comprehensive geophysical and lithofacies research indicates that a lithologic-lithofacies variation zone and structural steep and gentle variation zone exists in the Hengshan-Yan'an area, so paleo-geomorphic draped traps can be searched for, as can regional lithologic traps created by lithologic variations.

4. Expand field research on regional traps. This is an inevitable trend for leaping out of small rock body, small structure, small buried hill, and small fault traps. Large facies variation zones, overlap zones, and diagenetic-epigenetic zones are all basic geological conditions for the formation of regional traps.

5. On the relatively uplifted Yimeng slope, the search for traps should focus on upper Paleozoic clastic rock and lower Paleozoic carbonate rock dual-strata geologic structures. Generally speaking, the upper Paleozoic developed paleo-geomorphic draped traps, sandstone lens body traps, stratigraphic traps, nose-shaped fault traps, and so on. The lower Paleozoic developed stratigraphic traps, carbonate rock dissolution traps, and so on.

6. At the western margin overthrust zone, attention should be given to searching for structural traps related to faults, and even greater attention should be given to relatively simple large uplifts and anticline traps below nappe structure slippage surfaces.

Comrade Yang Suojie [2799 2747 2638] aiding in polishing this article, and I would like to express my gratitude here.

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Xinjiang Oil and Gas Exploration Reaches New Plateau

926B0124A Urumqi XINJIANG RIBAO in Chinese 17 Aug 92 p 1

[Article by reporter Zhang Chaowen [1728 6389 2429]]

[Text] Oil and gas prospecting in the three major basins of western China, Tarim, Junggar, and Turpan-Hami, continues to turn up promising oil and gas bearing structures while production of crude oil reaches a new plateau.

In the Tarim prospecting area, over 20,000 workers in search of large high-output oil fields found a series of oil and gas bearing structures in central and northern Tarim, examined 10 different structures, and found reserves sufficient to provide 5 million tons of crude oil for the Eighth 5-Year Plan construction. In addition to the seven oil and gas fields proven and under control in the Turpan-Hami Basin, other new oil and gas fields have been found, and it is reported that an annual output capability of 4 millions of crude oil has been targeted for the Eighth 5-Year Plan. Prospecting in the Junggar Basin is advancing from the rim toward the central desert region, China's first desert oil field is being readied in the southern Qaidam area, and oil strata several tens of meters deep have been found in the central basin, presenting conditions unlike anything that has been seen in the past 10 years. Production at old Karamai oil fields in the Junggar Basin is steady this year, the scale of production at newly developed oil fields continues to expand, and daily crude oil output levels have already met the annual production needs for 1993. Construction at two new locations in the Tarim and Turpan-Hami Basins is proceeding rapidly, and daily output of crude oil has far out paced the same period of last year. Total output of crude oil from the three basins this year could reach 8.7 million tons, an increase of 1 million tons over last year, and next year it will increase again by 2.3 million tons which will put the annual output of China's new oil region up over 10 million tons.

Huge New Gas Field in Central Shaan-Gan-Ning Basin Described

926B0126A Chengdu TIANRANQI GONGYE [NATURAL GAS INDUSTRY] in Chinese Vol 12, No 4, 25 Jul 92 pp a-b

[Article by Shi Xingquan [0670 5281 0356], director of the Changqing Petroleum Exploration Bureau: "Newly Emerging Large Gas Field in the Center of the Shaan-Gan-Ning Basin"]

[Excerpt] The Shaan-Gan-Ning [Shaanxi-Gansu-Ningxia] Basin located in central China is a favorable region for petroleum and natural gas exploration. In compliance with the strategic principle set forth by the CPC Central Committee and State Council for the petroleum industry of "stabilizing eastern China, developing western China" and under the guidance of the Petroleum and Natural Gas Corporation and Shaanxi Province, Ningxia Hui Autonomous Region, and Gansu Province, Changqing Petroleum Exploration Bureau has resolutely "combined oil and gas, coordinated development", made scientific deployments, used a small number of wells for widespread exploration, focused on reserves and concentrated on reservoir strata, spent more than 3 years in comprehensive exploration through "five positions in one body", and made breakthrough advances in natural gas exploration.

Overall, exploration for natural gas in the central part of the Shaan-Gan-Ning Basin can be divided into three phases: "major discoveries", "organized exploration", and "breakthrough advances". In phase one, the Shaan-can-1 and Yu-3 wells located on the eastern side of the northern end of the central paleouplift in Shaan-Gan-Ning Basin made important discoveries in July and September 1989 in locating resistance-free flows of 283,000 m^3/d and 136,000 m^3/d, respectively, in the Ordovician system weathered crust, opening the prologue of natural gas exploration in the central part of the basin. During the first half of 1990, resistance-free industrial gas flows of 106,000 m^3/d and 217,000 m^3/d were obtained from the corresponding strata positions at the Lin-1 and Lin-2 wells. This group of four wells basically controlled a substantial gas-bearing area. In phase two, based on the corporation's deployments, regional exploration was carried out over a scope of 15,000 km^2 in the central part of the basin and the focus of exploration was concentrated on a scope of 3,200 km^2 at the northern end of the eastern side of the central paleouplift, with 1,200 km^2 in the center being treated as a concentrated dissection region for concentrated efforts by the forces carrying out exploratory drilling. Gratifying high-output gas flows were obtained from eight wells. In phase three, all of the bureau's forces have been mobilized for organized exploration since November 1990,

especially after the Natural Gas Exploration Technology Meeting organized and held by the corporation. After over a year of extremely arduous struggle by employees on the front line, breakthrough advances were made in natural gas exploration. The success rate in well drilling surpassed 80 percent and a big integral carbonate rock gas field covering a large area with deep burial, low abundance, and moderate to low output is now basically in hand and the situation is continuing to improve.

I. Gratifying Achievements in Natural Gas Exploration

Thirty-nine wells have been drilled in the 1,200 km^2 concentrated dissection region. Analysis of the data indicates that the dominant gas strata in the entire region are widely distributed, the strata positions are stable and the small strata have a strong contrast, developed cracks and pores, and relatively good material properties. By the end of 1991, a group of reserves had been proven and controlled. Twelve wells were deployed within a scope of 1,000 km^2 north of the concentrated dissection region and four wells have obtained industrial gas flows. The reservoir strata preservation is intact and daily outputs of more than 100,000 m^3 have been logged in them. They also form an integral sheet with the concentrated dissection region in the central part and gratifying prospects of reservoir strata spreading continuously northward has appeared. In the 1,000 km^2 south of the concentrated dissection region, after systematic tests at the Shaan-12 well produced a resistance-free flow of 840,000 m^3, the Shaan-13 and Shaan-14 wells extending exploration further southward both logged gas flows, extending the favorable region for bearing gas greatly toward the south. In the regional exploration Chengchuan-1 well to the west of the concentrated dissection region, indications of three gas-bearing strata were seen. The reservoir strata have developed pores and cracks, indicating that there is substantial gas-bearing potential extending toward the west and revealing the gratifying prospect of a large gas region.

II. A Deeper Understanding of the Fundamental Geological Conditions of the Large Gas Field

In outline, there are five main points: 1) There are abundant gas sources. The data indicate that the basin contains several sets of hydrocarbon source rock, including the lower Paleozoic, upper Paleozoic, Mesozoic, and others. The thickness of the hydrocarbon source rock is particularly great in the upper and lower Paleozoic and it extends throughout almost the entire basin. 2) There are excellent reservoir strata. Two sets have already been discovered. One set is the main exploratory drilling target at present, the lower Paleozoic Ordovician system reservoir strata that are widely distributed throughout the basin. The other set is upper Paleozoic clastic rock strata that are distributed in the eastern and northern parts of the basin. 3) There are excellent capping strata, including the Carboniferous system Benxi group bauxitic mudstone and upper Shihezi group argillaceous rock as much as 200 m thick that extend throughout almost the entire basin, as well as the Carboniferous system tuff and gypsum that serve as a baseplate. They provide excellent preservation for upper and lower Paleozoic natural gas in the entire basin, which is an excellent geological condition for the formation of a large gas field. 4) There are superior sedimentary facies zones. According to existing data, the lower Paleozoic Ordovician system weathered crust Majiagou group dolomite is the dominant reservoir strata. It is widely distributed, the strata positions are stable, and there are wide variety of pores and cracks. They are mainly dissolution holes and are matched with pores, holes, and cracks, forming an accumulation and permeation network system and the connectivity of the main reservoir strata is relatively good. 5) There are excellent regional sheltering and entrapment conditions, with strata sheltering formed by the ancient terrain and upward-tilting lithologic sheltering as well as combinations of the two that played an extremely important role in formation of the large gas field. It is not hard to see from analysis of these geological conditions that the strata in the central part of the Shaan-Gan-Ning have stable comparative indicator strata. The inclination angle of the strata on the large monocline tilting toward the west is only about 0.5° and the reservoir strata positions are stable. The strata pressures (approximately normal pressure) are basically stable. The components of the gas are consistent overall and exhibit regularity, giving them the basic geological conditions for the existence of a large gas field and the formation of a large gas field.

III. Solid Basic Exploration Work

From its inception, exploration for natural gas in the central part of the Shaan-Gan-Ning Basin had adhered to the principle of high technical starting points, strict requirements on working styles, and neat, complete, and accurate data in focusing on basic work in exploration. 1) There has been resolute coring of the Ordovician system weathered crust in exploratory wells, attaining a core sampling rate of 95.37 percent; 2) There has been resolute logging 3,700 times. To date, logging has been done a total of 3,700 times at 31 wells and the gas strata interpretation conformity rate has reached 80 percent. In addition, dielectric, neutron load, and strata inclination angle logging has been carried out; 3) There has been resolute VSP logging that produced 42,900 m in VSP-CDP profiles; 4) There has been resolute unblocking acidification pressure cracking using about 50 m^3 of acid per exploratory well that has produced 3 to 10-fold increases in yields; 5) There has been resolute use of four working systems to carry out systematic well logging that produced logging data conforming to specifications; 6) There has been resolute corrective isochronous testing and delayed production for some wells that have produced dynamic data and provided preliminary output capability estimates; 7) There has been resolute standardized gas logging and well logging using comprehensive well logging instruments for some wells; 8) There has been resolute integration of scientific research with production, iron column strata profiles have been established for 20 wells, and on-site rock core inspection and

description and the large amount of data obtained from their use have been used to do single-well comprehensive evaluation centered on the structural characteristics of reservoir strata.

The undertaking of the work described above provides reliable first-hand data for gas field exploration and development that has played an important role in guiding exploration deployments, understanding the categories of gas traps, and correctly calculating reserves, and it won a good assessment from the Petroleum and Natural Gas Specialized Reserves Commission and National Reserves Commission.

The emergence of the large gas field in the central part of Shaan-Gan-Ning Basin has aroused the concern of the CPC Central Committee and State Council and attracted considerable attention from the Shaanxi-Gansu-Ningxia region and from Beijing and Inner Mongolia, all of which are ardently awaiting further development of the large gas field. The corporation has already included natural gas exploration in the Shaan-Gan-Ning Basin as one of three big key battlefields for exploration of new regions during the Eighth 5-Year Plan. A faster pace of natural gas exploration, development, and construction in the central part of Shaan-Gan-Ning Basin has extremely important strategic significance for the development of China's natural gas industry. [passage omitted]

Large-Scale Development of Cainan Oil Field

936B0011B Urumqi XINJIANG RIBAO in Chinese 14 Sep 92 p 1

[Article by correspondent Shao Zengan [6730 1073 1489]]

[Text] Cainan oil field, China petroleum industry's first desert oil field is being readied for large-scale development and construction.

In May 1991, at Cainan oil field, located in the heart of the Gurbantunggut Desert in Junggar Basin, the first exploratory well, Caican-2, brought forth industrial grade oil. The Jundong Prospecting Development Company of the Xinjiang Petroleum Administrative Bureau then immediately dispatched 10 drilling rigs, and after one and one-half years of drilling various kinds of exploratory and evaluation wells, over 30 developmental test shafts, totalling over 100,000 meters of well shafts, an impressive expanse of oil bearing territory and petroleum geology reserves were ascertained, and volumes of first-hand data were gathered. The daily rate of crude oil output from developmental test teams is over 380 tons, and the stage has been set for full-scale development of Cainan oil field.

The Xinjiang Petroleum Administrative Bureau has selected the personnel and established the Cainan Oil Field Development and Construction Directorate, and Directorate leaders were on station at Wucai Wan by early September to direct and coordinate the development and construction of Cainan oil field.

The estimated investment for Cainan oil field is 1.1 billion yuan, and after more than a year Cainan oil field will have a quite highly automated oil extraction capability to produce nearly 1 billion tons of crude oil.

VP of China National Nuclear Corporation Comments on Expansion of Nuclear Industry

40100015A Hong Kong TA KUNG PAO in Chinese 13 Oct 92 p 4

["New Information on Opening Up" column by staff reporter Cheng Kang-ying [6774 6921 5391]: "China's Nuclear Industry Taps Overseas Market—Interview With Li Dingfan, Vice President of the China National Nuclear Corporation"]

[Text] Li Dingfan, vice president of the China National Nuclear Corporation, told reporters yesterday that the principles governing China's export of nuclear industry-related science and technology are as follows: (1) It should be used for peaceful purposes; (2) it should be subject to inspection by the International Atomic Energy Agency; (3) relevant technology may not be transferred to a third country without China's consent.

Li Dingfan noted that as long as the three aforementioned principles are observed, then China will not be influenced by other countries nor will it take notice of pressure from other countries. While China does not advocate nuclear proliferation, it opposes using this as an excuse to deprive developing countries of the legitimate right to use nuclear energy for peaceful purposes.

Li Dingfan is the head of a Chinese nuclear industry trade delegation which is in Hong Kong to take part in a news conference related to the "1993 Hong Kong seminar on international cooperation on the peaceful use of military technology." He made the above statements in an interview with reporters at his hotel yesterday.

He stated: The China National Nuclear Corporation is a national industrial corporation which evolved from the former Ministry of Nuclear Energy, and which incorporates science and technology, industry, and trade. It is charged with production, operations, scientific research, development, and construction related to China's nuclear industry. In describing the 30 years since China's nuclear industry was created in 1955, he said that a complete system in nuclear science and technology and industry has been formed to establish China's position in the world nuclear domain.

Li Dingfan went on: Since 1979, when the focus in the development of China's nuclear industry was shifted to serving the national economy by adopting the guidelines of "nuclear energy as the principal means supplemented by various types of operations," outstanding accomplishments have been scored over the past decade. By the end of 1991, the output value of the corporation's civilian industries already accounted for 50 percent of the corporation's total output value and is expected to reach some 80 percent in the coming years.

He said: In order to satisfy the energy demands in national economic construction endeavors, developing nuclear power is the primary task of the nuclear industry at the moment. On one hand, they rely on their own efforts to make full use of the existing industrial base, and at the same time, absorb foreign technology, purchase some key equipment, and develop nuclear power technology independently; on the other hand, they also import complete sets of foreign nuclear power units. Construction of the Qinshan nuclear power station and the Daya Bay nuclear power station was initiated by following these two formulas.

Importing Technology To Build Nuclear Power Plants

In the application of nuclear technology, Li Dingfan noted that nuclear technology accumulated over decades of development in China's nuclear industry is presently being transferred actively into the civilian industrial sector where the expertise and technological edge of the nuclear industry are actively applied in the construction of pressing projects related to the national economic development to produce industrial products needed in economic construction and in people's daily lives. These products include instruments and meters, metal materials, rare earth products, construction materials, chemical machinery, fine chemicals, light industrial products, and others.

He pointed out: China's nuclear industry was built on the basis of self-reliance, and its technology and experience are very much suited to the needs of developing countries. In line with the principle of "equality, mutual benefits, and joint development," it engages in cooperation with Third World countries and regions in the peaceful application of nuclear energy and nuclear technology.

He went on: Small Chinese nuclear reactors have already been exported to the Third World, including a 10-megawatt heavy water research reactor which was exported to Algeria, and which became fully operational in July this year; last December, China and Pakistan signed a contract providing for the export to Pakistan of a 300,000-kilowatt nuclear power unit. China has won extensive welcome from the Third World countries regarding its efforts in the peaceful application of nuclear energy.

Search for Foreign Cooperation

Speaking on this visit to Hong Kong to prepare for next year's exchange meeting on international cooperation of conversion of military to civilian industries, Li Dingfan stated that this exchange meeting is the first such large-scale activity to be held in the territory, adding that the China National Nuclear Corporation will take part and carry out exchanges by mobilizing 70 units from its system and bringing more than 200 products and items under 16 major categories to the meeting. The modes of cooperation will be flexible and may include joint equity construction, use of foreign capital, compensation trade, importation of technology, importation of facilities, joint development, cooperation in production, establishment of factories outside the territory, building contracts, and distribution of products.

Li Dingfan stated: The application and development of nuclear energy is the focus of the corporation's external cooperation. China will step up the pace of nuclear power construction as it plans to build several 300,000- and 600,000-kilowatt nuclear power stations in the short term period. Some $1.6 billion in foreign capital will be needed to bring in the necessary technology as well as the necessary facilities and materials. Meanwhile, the corporation will also offer 300,000-kilowatt nuclear power units and research reactors to the international market. In addition, cooperation is also sought for more than 40 planned construction projects which will require a total investment of roughly 3 billion yuan renmibi and $300 million in foreign capital.

He said: The China National Nuclear Corporation has already prepared dozens of plots spanning 700,000 square meters for joint development with foreign businesses. These plots are found in Beijing, Shenzhen, Qinhuangdao, Pudong, Dalian, Lanzhou, Changsha, Chengdu, Jiujiang, Yueyang, Yining, and other cities. Joint efforts may be carried out to build commercial and residential buildings, as well as to develop the service, processing, and other civilian industries.

Tests Begin at Daya Bay

936B0005A Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 2 Oct 92 p 1

[Article by reporter Chen Anming [7115 1489 2494]]

[Excerpt] [passage omitted] Construction of the Guangdong Daya Bay nuclear power plant formally began in August 1987. The first of two 900,000 kW pressurized-water reactors is expected to join the grid in October 1993. When fully operational the annual power output will be 10 billion kWh, and combined with the pumped-storage power station supply, the Guangdong, Hong Kong, and the south China area could be supplied with up to 12.6 billion kWh of power. Now, the construction of the nuclear island, the conventional island, and accessory facilities is basically completed, and installation work is in the final stages. Individual system tests and full-scale joint tests are unfolding, and the operating personnel are coming on board.

Authorities of the Guangdong Nuclear Power Joint Corporation describe Daya Bay as a Chinese-foreign large-scale commercial nuclear power plant. Investment for construction was approximately 4 billion U.S. dollars, the major portion of which was foreign export funds, commercial loans, and 1980's international advanced level technology and facilities were imported for the plant. It is forecasted that within 15 years after it goes operational the investment will be paid off.